

# Robust Engineered Thermal Control Material Systems for Crew Exploration Vehicle (CEV) and Prometheus Needs, Phase II

Completed Technology Project (2006 - 2008)



## Project Introduction

This innovative SBIR Phase II proposal plans to develop new multifunctional high temperature capable TCMS technologies based on the identified needs for the thermal control and ESD functions of the exploration mission hardware and also for the heat rejection system. These efforts can also serve uniquely the Crew Exploration Vehicle radiator systems needs. The TCMS for the radiators of the both CEV and exploration missions need to operate at higher elevated temperatures and provide the space environment stable low ratio of (solar absorptance/emittance) performance in high radiation orbits involving intense UV, electrons and protons along with stable charge mitigation. The CEV application also needs it to withstand typical launch environments. According to the phase I findings, none of the state-of-an-art material systems that are currently in use are designed for the needs of the space environment stable operation at elevated temperatures, and hence, can not meet the same. The Phase I efforts proved the feasibility and identified the next generation solid state chemistries and processing requirements that can provide the multifunctional space stable performance at higher temperatures and also provided the unique guidance for tailoring the ESD performance when these very large thermal control areas get exposed to very low temperatures. The proposed phase II efforts will continue R&D and scale up the synthesis of the identified candidate engineered passivated pigments and validate its space environment stability with use of recently developed next generation negative CTE passivated additives with abilities to tailor CTE, thermal shock and thermal cycling performance. Thus, these Phase II efforts can provide the next generation "Robust" validated TCMS products that can be exposed to the elevated temperatures (500C) and conducting tasks geared towards putting together plasma spray technology and experience base as applied to TCMS for various exploration missions.

## Anticipated Benefits

Potential NASA Commercial Applications: Like NASA, the commercial industry has planned several satellite platforms for the broad band communication activities. The FAA and NASA are also planning commercial space based radars for air traffic control and distant planet observations and robotic exploration and communication. Such radar platforms are also planned by DOD for the battle-field management, and such platform structures are expected to be large and sizable, where charge accumulation can be an over riding concerns along with operation of the platforms at elevated temperatures. These planned candidate radar application assets and their fleets of such integrated space systems may require putting assets in the mid-earth orbits (MEO) for over all optimization and minimization of mission costs. Such mission and fleet designs can be possible and can be economic only if the "robust" material technologies are made available that can perform at high temperatures without failure. Currently no material technology exists that can mitigate synergistic high temperature and space environment induced degradation effects. Many NASA



Robust Engineered Thermal Control Material Systems for Crew Exploration Vehicle (CEV) and Prometheus Needs, Phase II

## Table of Contents

Project Introduction	1
Anticipated Benefits	1
Organizational Responsibility	1
Primary U.S. Work Locations and Key Partners	2
Project Management	2
Technology Areas	2

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Glenn Research Center (GRC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

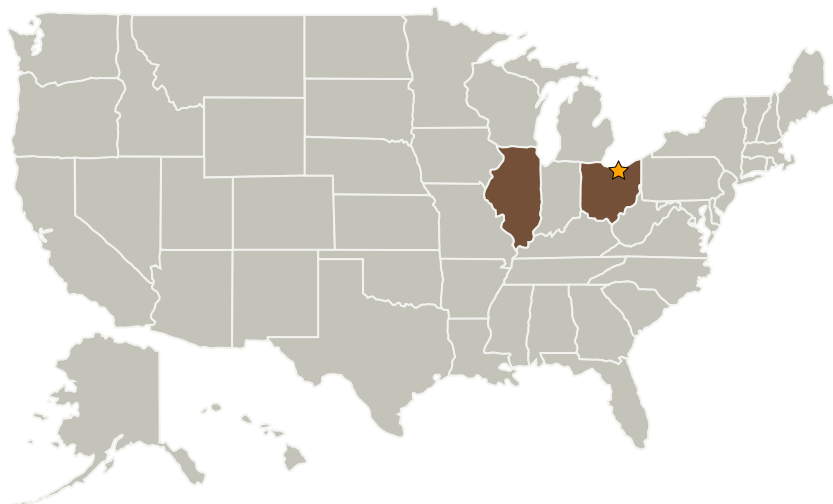
# Robust Engineered Thermal Control Material Systems for Crew Exploration Vehicle (CEV) and Prometheus Needs, Phase II

Completed Technology Project (2006 - 2008)



planetary, the commercial and some of the DOD platform hardware devoted to the radar applications are also expected to operate at higher temperatures and thus will significantly benefit from the new validated material systems technology being developed through this phase II SBIR R&D and validation efforts.

## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Applied Material Systems Engineering, Inc. (AMSENG)	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Schaumburg, Illinois

## Primary U.S. Work Locations

Illinois	Ohio
----------	------

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Mukund S Deshpande

## Technology Areas

### Primary:

- TX14 Thermal Management Systems
  - └ TX14.2 Thermal Control Components and Systems
    - └ TX14.2.3 Heat Rejection and Storage